
Determining the Effects of Fungicide Contamination of Nectar and Pollen on Honey Bee Colony Health

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Objectives:

- 1) Determine the effects of Pristine on the nutritional components in bee bread.
- 2) Determine the effects of Pristine on the presence of fungi in pollen and bee bread.
- 3) Determine the effects of Pristine on brood survival and queen rearing.

Interpretive Summary:

Completing the Objectives of this study is being accomplished by dividing them into two parts: 1) Quantifying the amount of fungicide in pollen collected by bees in almond orchards and determining the effects on colony health, and 2) assessing the effects of fungicides on fungi we could culture from bee bread and those whose DNA could be isolated by molecular methods. Pollen used in this study was collected with pollen traps on bee hives located in three almond orchards. The pollen was analyzed for the presence of pesticides and fungicides (Fig. 1). Pollen samples were taken early, and near the end of bloom in two orchards and early middle and late in bloom in another. Some fungicides (2-4 different types) were detected in the pollen from each orchard site.

The pollen we collected was fed to bees in an enclosed flight arena located at our Laboratory. The pollen pellets were ground into a powder so that the bees could collect it, store the pollen in cells, and process it into bee bread. The bee bread was sampled at weekly intervals and analyzed for fungicide concentration, microbes, protein content, and amino acids. In addition, 4-day old workers were sampled from colonies and their protein concentration and hypopharyngeal gland development were analyzed as indirect

measurements of their ability to digest and metabolize pollen contaminated with fungicides. Data from these studies are being analyzed.

In addition to studies of the effects of fungicides at the colony level, we examined the effects directly on fungi isolated from bee bread. When we added various concentrations of Pristine[®] fungicide (Registered Trademark of BASF) (0.1-100 mg/ml) to fungus growth media, we detected a marked reduction in growth of all 12 fungi we isolated and cultured from bee bread. The reduction in growth varied from 12% - 80% depending on species and concentration. Nine species were killed at higher fungicide concentrations (>1.0mg/ml). *Penicillium* sp. and *Aspergillus niger* were especially sensitive to fungicide, displaying pronounced stunted growth and quick death. Similar results of reduced growth were obtained when Orbit[™]-Tilt[®] or Bravo[®] fungicides (Syngenta) were added to culture media, though none of the fungi were killed. We also collected bee bread from colonies placed in almond orchards for pollination and found Chlorothalonil, Cyprodinil (Vanguard), Fenbuconazole, Iprodione (Rovral), Boscalid and Pyraclostrobin (Pristine), and Pyrimethanil in bee bread. We cultured the fungi from the bee bread and found significant decrease in the fungal diversity and growth. The effects of the reduced microbial diversity in bee bread on the ability of bees to process pollen will require completion of the analysis from the colony level experiments.

Figure 1. Fungicides detected in honey bee collected pollen from three almond orchards.

